9-1948

Aspen Lumber Grades and Characteristics

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LAKE STATES ASPEN REPORT NO. 6

ASPEN LUMBER GRADES AND CHARACTERISTICS

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SEPTEMBER 1948

PROCESSED BY
U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
LAKE STATES FOREST EXPERIMENT STATION

FOREWORD

During and since World War II, there has been increasing interest in aspen (Populus tremuloides) in the Lake States, its availability and supply, properties and uses, and management. Aspen is a tree of primary importance in 20 million acres or 40 percent of the total forest area of the three Lake States - Michigan, Minnesota, and Wisconsin.

At an informal meeting at Madison, Wisconsin, in January, 1947, forestry representatives of several federal, state, and industrial groups in the Lake States agreed that it would be desirable to bring up to date what is known on aspen and make it available to anyone interested. The job of preparing this information in the form of reports was assigned to each of the groups listed below. The reports will be duplicated as rapidly as completed, and the entire project should be finished by the end of 1947. Each report will concern one aspect of the subject. Copies will be available from the Lake States Forest Experiment Station or from each contributor.

Report Number	Subject
1	Aspen Properties and Uses
2	Aspen Availability and Supply
3	Logging Methods and Peeling of Aspen
4	Milling of Aspen into Lumber
5	Seasoning of Aspen
6	Aspen Lumber Grades and Characteristics
7	Mechanical Properties of Aspen
8	Machining and Related Properties of Aspen
9	Aspen Lumber for Building Purposes
10	Aspen for Containers
11	Aspen for Core Stock
12	Small Dimension and Other Industrial Uses of Aspen
13	Aspen for Veneer
14	Aspen for Pulp and Paper
15	Aspen for Cabin Logs
16	Aspen for Excelsior
17	Aspen Defiberization and Refining of Product
18	Chemical Utilization of Aspen
19	Preservative Treatment of Aspen
20	Marketing of Aspen
21	Possibilities of Managing Aspen

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I

LUMBER GRADING

Current Practices

While most hardwood and softwood lumber usually is graded, aspen lumber is not. On the contrary, it is usually sold by the sawmill to the wood manufacturing plant on a mill-run basis. Plants which saw aspen lumber for their own use rarely apply standard grades in sorting the lumber. They usually separate the "usable" from the "cull" lumber, basing their grade breakdown upon the minimum quality acceptable in their manufacturing process. Manufacturers who use only certain grades of aspen lumber, and who buy it on the open market, have been unable to locate sources from which graded aspen lumber is available.

Grade Rules For Aspen Lumber

Although grading of aspen lumber is not generally practiced, grades for this species are recognized in the official grading rules of the lumber associations covering the Lake States region. There are at present three separate sets of grading rules for aspen lumber. The National Hardwood Lumber Association provides for grading aspen as hardwood factory lumber and as construction lumber (1) 2/. Under the hardwood factory lumber rules, aspen grades are identical with those for sap gum, cottonwood, black gum, tupelo, magnolia, and willow. The grades are Firsts and Seconds, Selects, No. 1 Common, No. 2 Common, No. 3A Common, and No. 3B Common. Sound Stain is no defect in any of these grades. All are standard hardwood grades except No. 2 Common and No. 3 Common which require "sound" instead of "clear-face" cuttings.

The construction grades under the hardwood rules are A finish - B finish, No. 1, No 2, and No. 3 construction boards, and No. 1 and No. 2 dimension.

1/ Maintained by the U. S. Department of Agriculture, Forest Service, in cooperation with the University of Minnesota, University Farm, St. Paul 1, Minnesota.

2/ Underscored numbers in parentheses refer to literature cited.

Aspen is graded as a softwood yard lumber along with northern white pine, jack pine, Norway pine, eastern spruce, and balsam under the rules of the Northern Hemlock and Hardwood Manufacturers Association (3).

The Northern Pine Manufacturers Association has drawn up a separate set of rules for the inspection of aspen lumber (4). The grades are Select and Better, No. 4 and Better Common with Select and Better sorted out, and No. 5 Common. Further descriptions of these grades according to the rules are as follows: the Select and Better grade is to be comparable to No. 1 Common and Better hardwood grades; No. 4 and Better Common with Select and Better sorted out is to be comparable to a combination of No. 1, No. 2, and a small percentage of No. 3 Common hardwood grades; the No. 5 Common grade is comparable to the grade of No. 3 Common hardwood.

Characteristics of Aspen in Relation to Standard Lumber Grades

Because aspen ordinarily is a small tree, its production of high quality lumber and balanced lumber stocks is limited. A survey of current log supplies found in three mills in northern Minnesota, where there is a higher percentage of good aspen sites than in other Lake States (7), shows (Table 1) that 40 percent of the log-scale volume was in logs 8 inches or less in top diameter, 42 percent of volume was in logs 9, 10, and 11 inches in top diameter, and 18 percent of the volume was in logs 12 inches and over in top diameter. The sawmills included in the survey purchased logs 6 inches and larger in top diameter for sawing.

Table 1.--Approximate distribution of log-scale volume for aspen log supplies in three northern Minnesota yards by top diameter class.

Top diameter	Percent of total volume 1/
Inches	
6	9
7	19
8	12
9	21
10	17
11	4
12	12
13+	6

1/ Based on 1,087 logs.

Top diameter of logs to a large extent governs the width of lumber that can be recovered from logs. A study described by Rees (8) showed that about 34 percent of the aspen lumber produced was less than 5 inches wide, about 48 percent was 6 to 8 inches wide, and the remaining 18 percent was wider than 8 inches. This report also indicates that accumulations of narrow-width lumber can be prevented by eliminating the logs in the 5, 6, and 7-inch top diameter classes. However, since most of the narrow boards

are sawed from the outer part of the log, they comprise the best quality lumber available in the log. A large share of clear aspen lumber is eliminated from the upper hardwood grades because it does not meet lumber width specifications.

The small size of aspen makes it more suitable for the production of boards, strips, and small dimension material such as 2x4's and 2x6's than for timbers, posts, stringers, and planks.

The number and size of defects help determine the grade of lumber and logs. Defects such as knots, shake, stain, and decay, are commonly associated with the center of the log (5). In aspen logs 9 inches and under in size, very few boards can be sawed without encountering some of these center-log defects; therefore, very little clear-grade lumber can be expected from a large part of logs available to a sawmill. One very damaging defect in aspen is the unsound knot. These usually occur in the butt logs. They are the result of rapid diameter growth surrounding dead branch stubs. On good sites it might pay to eliminate this defect by early pruning.

Although aspen on good sites can produce clear-length logs 10 to 16 feet long, logs seldom are cut for their clear length. It is common practice in the Lake States to cut aspen into 100-inch log lengths. This practice in itself prevents manufacture of a balanced aspen lumber stock to meet lumber grades. A few aspen operations in the Lake States have cut random-length logs instead of 100-inch logs. These indicate that aspen is adaptable to random-length log operations which give better lumber grade recovery. The cutting of aspen into 100-inch length logs obviously contributes to degrading aspen in log and lumber production under present grade rules.

Aspen's susceptibility to decay not only contributes to a degrade in lumber, but also accounts for the loss of a large number of what would otherwise be high-quality trees. Discoloration and the early stages of decay may begin in aspen at an early age. (9). Since the early stages of deterioration are considered sufficiently sound to be included in lumber, full scale can be recovered from trees up to about 50 or 55 years of age. After that, heart rot progresses rapidly and lumber from the center of the tree will be cull. However, this is also the time when highest quality wood is being put on by the tree. Although these large trees with heart rot contain a substantial volume of high-grade lumber, they are not ordinarily utilized because lack of grading does not permit recognizing quality in aspen, and the cost of handling the cull volume more than offsets the value of the available sound, high-quality wood.

Lumber-Grade Yields From Aspen

In order to obtain information on lumber-grade yields from aspen the Lake States Forest Experiment Station conducted studies at three sawmills in northern Minnesota 3/. Two of these mills were circular mills, and one was a combination circular and gang-saw mill. Two of the mills sawed 1-inch lumber, and the third mill sawed both 1-inch and 6/4 lumber.

3/ The author acknowledges the help of Mr. A. C. Wollin of the Forest Products Laboratory, Madison, Wisconsin, in collecting the lumber grade yield information.

It was recognized in the study that log quality directly affects grade yields. To give proper consideration to this fact, preliminary log rules were drawn up and used to classify the logs. Four hundred and thirty-one logs were diagrammed in detail and followed through the sawmill individually to determine the grade and amount of lumber available from each. The logs ranged from 6 to 14 inches in top diameter. The hardwood factory grades were used to determine yield.

From information obtained in the study it is estimated that a million board feet of aspen lumber sawn from present aspen supplies in northern Minnesota, where utilization is to a 6-inch top, will contain the following amounts of lumber by grades:

Grade of lumber 1/	Volume in board feet	Percent
F & S	12,000	1.2
Selects	8,000	0.8
No. 1 Common	120,000	12.0
No. 2 Common	520,000	52.0
No. 3A Common	200,000	20.0
No 3B Common	140,000	14.0
Total	1,000,000	100.0

1/ National Hardwood Lumber Association grades.

Interviews with officials of several wood-using concerns, sawing their own aspen lumber on approximate grade yields, confirm the information given above. One company which produces glued core panels estimates their usable grade to be lumber equal to hardwood grade No. 2 Common and Better, and states that 70 percent of their aspen production is usable in their cut-up shop for cores, 30 percent being below grade. The lower grades are No. 3A and 3B Common, which approximate the 34 percent shown above. A second concern which manufactures boxes estimates their usable grade to include a portion of the 3A grade and Better lumber. The usable grade amounted to 80 percent of their production and the cull grade 20 percent. A third sawmill which produces aspen for sale to box factories states that 84 percent of their lumber is usable for box manufacture. Sixteen percent is in cull grade and must be used for other purposes. At this mill only lumber grade 3A Common and Better is sold in the usable grade.

Summary

Because aspen lumber has entered many new uses during the past few years, there is an apparent need for better grading of the lumber. Each type of use requires a specific grade of lumber. Many buyers have been disappointed

in their experience with aspen largely because the type of wood available was not the grade they wanted. Lack of grading has deprived aspen of some markets. Moreover, considerable misunderstanding has occurred between buyers and sellers on the basis of grade rules now available.

With three separate sets of grading rules now recognized for aspen, producers are handicapped in not knowing how to grade their stock. A necessary step in promoting the grading of aspen is the setting up of one standard grade to cover the species, as has been done for many coniferous species. The step taken by the Northern Pine Manufacturers Association in combining the softwood and hardwood rules may have merit. However, further refinement will be necessary to establish grades which will permit the segregation of lumber for uses other than boxes and crating.

II

LOG GRADING

Current Practices

Most aspen logs are sold on the basis of size. Each sawmill sets a minimum size it will accept. The minimum top diameter usually varies from 6 to 8 inches, depending on the size and quality of aspen logs available in the locality. One concern which makes aspen matches limits the number of surface defects and specifies size of logs it will buy. Recently a few buyers in Minnesota have been advertising for "clear white aspen logs." There are indications that there is an increasing interest in buying aspen logs on a quality basis.

Log Grade Rules

The Forest Products Laboratory has developed log grade specifications for hardwood logs from studies carried on in northern hardwoods (5). These log grades have been tried by several manufacturers and are in use in some areas. Aspen, because of its small size, cannot produce high grade logs under these specifications. Log grade No. 1 requires a top diameter of 12 inches for butt logs and 16 inches for other than butt logs. Log grade No. 2 reduces the top diameter specifications to 10 inches. Log grade No. 3 permits 8 inches top diameter. Table 1 indicates that on the basis of top diameters 18 percent of the total log volume could go into log grade No. 1; 39 percent is suitable for log grades Nos. 1 and 2; and 72 percent can be admitted into log grades Nos. 1, 2, and 3; 28 percent falls below log grade No. 3 (6 and 7-inch top diameters). The practice in the Lake States of cutting aspen logs into 100-inch lengths prevents high grade log production under these hardwood log grades.

The Official Grading Rules for northern hardwood and softwood logs, tie cuts, box bolts, etc. of the Northern Hemlock and Hardwood Manufacturers Association set up a grade rule for aspen (2). In the rules, aspen is included with Norway and jack pine, spruce, white cedar, tamarack, hemlock, and balsam. One log grade is recognized for these species. This grade specifies minimum requirements as to length, top diameter, and net scale.

Adaptability of Aspen to Log Grading

In connection with the study to determine the lumber grade yield from aspen, information was collected on the adaptability of aspen to intensive log grading. The preliminary log grades drawn up for the study were adapted from the hardwood grade rules developed by the Forest Products Laboratory (5), but changed for log size and defects to take care of aspen tree characteristics and the common practice of cutting logs into 100-inch lengths. These preliminary log-grade specifications were as follows:

Grade	Minimum length Inches	Minimum d.i.b. Inches	Description
1	100	6	Logs must be 100 percent sound. No sweep permitted. Logs must have at least 5/6 of 3 faces clear in not more than one cutting. Cuttings to be 7 feet long and width of face.
2	100	6	Net scale of log to be more than 70 percent of gross scale including deduction for sweep. Three faces to be 3/4 clear in not less than 2 cuttings. Cuttings to be 3 feet long or longer and full width of face.
3	100	6	All logs which do not fit into the above grades if 50 percent sound.

The lumber-grade yield data by log grades (Table 2) indicate that log size is a major factor influencing grade yield. Also, for aspen, there is little difference in grade yield between log grades for logs under 9-inch top diameter. Consequently, the segregation of these small-sized logs on the basis of visible defects is of no practicable value as they can all be considered as one log grade. Logs with 9-inch top and larger show a substantial difference in grade yield between log grades. In these logs the measure of defect-free areas assists in predicting grade yield and helps to establish the quality of the log. Therefore, the minimum top diameter for aspen log grades Nos. 1 and 2 should be 9 inches rather than 6 inches, as is shown in the preliminary specifications used.

For the purpose of appraising the grade yield of aspen logs under current methods of utilization and production, information was collected by sampling 1,087 logs at three sawmill yards in northern Minnesota. Log grade by diameters, based on the preliminary log grades used in this report, was as follows: (Page 8)

Table 2.--Summary of grade yield by log grade for aspen.

Log diameter groups	No. of logs	Lumber-grade yield 1/						Total number scale	Net log scale (Scribner)
		F&S	Sel.	No. 1C	No. 2C	No. 3A	No. 3B		
Inches		Percent						Bd.ft.	Bd.Ft.
Grade 1 Logs									
6	1	..	..	23	39	23	15	13	5
7	..	..	..	..	..	..	..	..	..
8	8	..	..	7	53	25	15	190	90
9	11	2	1	17	54	19	7	429	280
10	15	2	2	31	46	13	6	782	450
11	13	8	3	31	45	11	2	704	450
12	14	4	9	38	38	7	4	977	720
13+	9	13	4	40	33	8	2	681	560
Total	71							3,776	2,555
Average		6	4	32	42	11	5		
Grade 2 Logs									
6	12	..	..	..	50	20	30	165	65
7	16	..	..	9	50	17	24	310	180
8	31	..	..	9	54	25	12	759	350
9	39	..	..	15	61	12	12	1,227	860
10	27	1	..	20	63	13	3	1,141	810
11	20	2	1	25	43	18	11	1,160	700
12	9	..	..	28	45	17	10	465	360
13+	11	7	..	32	46	9	6	802	610
Total	165							6,029	3,935
Average		2	(2/)	20	53	15	10		
Grade 3 Logs									
6	30	..	..	..	49	21	30	395	165
7	38	..	..	..	45	26	29	698	390
8	43	..	..	1	52	29	18	1,112	560
9	28	..	..	1	62	25	12	1,189	770
10	28	..	..	2	60	33	5	1,269	870
11	17	..	..	6	63	24	7	913	570
12	4	..	..	11	60	21	8	251	180
13+	3	..	..	15	46	27	12	192	150
Total	191							6,019	3,655
Average		..	..	3	56	27	14		

1/ Lumber yields not adjusted as to percentages of short lengths permitted in standard grades.
2/ Less than 0.5 of 1 percent.

Table 3.--Log grades for logs of varying size.

Top diameter of log (Inside bark)	Log grade			Basis
	No. 1	No. 2	No. 3	
Inches	Percent			No. of logs
6	..	15	85	178
7	..	28	72	298
8	8	28	64	192
9	15	35	50	140
10	20	37	43	93
11	41	41	18	46
12	41	35	24	51
13+	73	18	9	89

Yield of Aspen for Veneer Logs

The availability of aspen for veneer depends to a large extent on the size specifications adopted for veneer logs. Veneer log grades of the Northern Hemlock and Hardwood Manufacturers Association use 12 inches as a minimum top diameter for short logs. Only about 18 percent of the log volume in current aspen log supplies in northern Minnesota is large enough to meet this specification (Table 1). However, 73 percent of the logs 12 inches and larger in diameter will meet the surface requirements for clearness (Table 3). This is true because most of the aspen logs 12 inches and larger in diameter are butt logs.

On a basis of veneer log specifications, as used for match bolts, where a minimum top diameter of 8 inches is acceptable, the veneer log supply of aspen is greatly increased. Seventy-two percent of the log volume in present log supplies is 8 inches and over in diameter (Table 1). However, this figure should be reduced by about 15 percent to eliminate logs which will not meet surface requirements.

Summary

The increasing interest in log grading makes it desirable to continue studies of aspen log quality. Aspen grows under a wide variety of conditions, and this causes a wide variation in stand quality. The study reported here indicates that the grade yield of lumber can be measured in aspen logs by grading The establishing of log grade specifications will be helpful both to buyers and sellers. Each will be able to determine the value of the material they are handling. Log grading can help direct the logs to the specific uses to which each is best adapted. Log grades can be used in appraising the value of standing timber. Log grading can be of value to forest managers, since it provides a measure by which quality growth can be determined.

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